TCPB Research Final Report – December 19, 2014

Title: Evaluation of Late Corn Planting with Early Maturing Hybrids in Texas High Plains

Investigators: Qingwu Xue, Thomas Marek, and Baozhen Hao; Texas AgriLife Research and Extension Center –Amarillo; 6500 Amarillo Blvd. W., Amarillo, TX 79106; Phone: (806) 354-5803; Fax: (806) 354-5829. E-mail: Qxue@ag.tamu.edu; TMarek@ag.tamu.edu.

Project dates: April 1, 2014-December 31, 2014

Project locations: Texas AgriLife Research, Bushland and Etter, TX.

Summary: Field experiments were conducted in the Texas A&M AgriLife Research stations at Etter and Bushland, TX. The treatments were consisted of 6 hybrids and 4 target planting dates (May 15, June 1, June 15 and July 1). The hybrids used in 2014 were 4 Pioneer hybrids (33D53AM-R, P1151AM, P0365YHR, and P9690AM) and 2 Syngenta short season hybrids (N41Y and N42Z-Artesian). Their relative maturity days were 115, 111, 103 and 96, respectively. The actual planting dates were May 15, May 30, June 16, and June 30 2, 2014 in Etter, and May 19, June 2, June 13, and July 1, 2014 in Bushland. The planting density was 30,000 seeds/ac for all hybrids. In overall, corn yields were higher than 2013, and ranged from109 bu/ac to 242 bu/ac, depending on location, planting date and hybrid. Although the high yield (>200 bu/ac) still can be achieved with long season hybrid (e.g., >111 d) when planted from the middle of May to middle of June in the North Texas High Plains, some short season hybrids also yield well (180-200 bu/ac) at June-16 planting date. When planting date was delayed to about July 1, mid- and short- season hybrids showed the yield advantage over long season one. In general, delaying planting to late June or early July reduced yield potential. However, late planting reduced crop water use but did not affect WUE in short season hybrids. As such, late planting potentially can save some irrigation water while maintain the high WUE.

Research background: Interests have been growing into late planting corn in the Texas Panhandle because hot and dry conditions occur frequently during normal planting season (mid-April to May). For example, the severe dry and hot conditions in the month of May in 2011 resulted in significant adverse conditions to corn plants seeded in late April and early May. In this situation, delayed planting to early June ended up to improved corn yield and profits for several local producers. The benefits of late planting may include 1) potentially saving irrigation water; 2) avoiding peak abiotic stresses such as heat; 3) potentially replanting in case early-planted crop failure (e.g. hail). The additional water savings may be from earlier maturing hybrids such as 95-d maturity hybrids. Data already exists for corn planting dates from March to May in the Texas Panhandle. In the past, corn was often planted early to avoid high populations of insects. Since most new hybrids have insect-resistance traits, it may not be necessary to plant corn early to avoid insects. In addition, a crop model analysis using Texas High Plains historical weather data, suggests that the corn yield potential increases as planting date is delayed under dry and hot conditions. Nevertheless, there is little measured field data for late-planted corn performance, especially the early maturity hybrids. Late-planted and early maturing corn hybrids may play an important role in the future of corn production in the Texas Panhandle.

Objective: Investigate the effects of late panting and early maturity on corn yield and water use.

Procedure: Field experiments were conducted in the Texas A&M AgriLife Research stations at Etter and Bushland, TX. The hybrids used in 2014 were 4 Pioneer hybrids (33D53AM-R, P1151AM, P0365YHR, and P9690AM) and 2 Syngenta short season hybrids (N41Y and N42Z-Artesian). Their relative maturity days were 115, 111, 103 and 96, respectively (Tables 1-3). The experiment design was a split-plot design with three replications. The planting date was whole-plot and hybrid was sub-plot. The plot size is 30 ft long and 10 ft wide (4 30-in rows). The planting density was 30,000 seeds/ac for all hybrids. Soil fertility was assessed before first planting date and established at an adequate rate for full irrigation production level. The actual planting dates were May 15, May 30, June 16, and June 30 2, 2014 in Etter, and May 19, June 2, June 13, and July 1, 2014 in Bushland. During the growing season, irrigation was applied to target 100% evapotranspiration (ET) requirement. Weeds were controlled by chemical control at early stage. No insecticides were applied during the season. Field data collection included soil water content, the amount of irrigation and precipitation, and yield. Crop total water use (seasonal ET) was calculated using a water balance model between first planting and after harvest, and WUE was calculated as the ratio of yield and ET. Due to the stands issues, the plots of June 13 planting date at Bushland were abandoned. The plots in Etter were machine harvested in the late October, 2014. Plots in Bsuhland were hand harvested. In addition, we also collected silking (R1) and maturity (R6) dates in part of plots at both locations. Growing degree days (GDDs) were calculated using mean daily temperature and a base temperature of 10^{o}C.

Results: At both locations, silking and maturity dates were related to relative maturity of the hybrids and planting date. In general, silking and maturity became earlier in short season hybrids. Consistently at both locations, the Pioneer P9690AM reached to R1 and R6 at the earliest as compared to the 2 Syngenta short season hybrids and other longer season hybrids. The difference of silking and maturity dates between the earliest and the latest hybrids was up to 7 and 22 days, respectively. As planting date was delayed from middle of May to the middle of June, the GDDs to R1 and R6 decreased (Table 1).

Corn yields ranged from109 bu/ac to 242 bu/ac, depending on location, planting date and hybrid. The average yield at Etter (189 bu/ac) was higher than that at Bushland (148 bu/ac), mainly due to more irrigation application at Etter than Bushland. For example, the first planting date (May 15) plots received 23 inches of irrigation at Etter but only about 12 inches at Bushland.
In general, corn yield decreased when planting date was delayed to about June 15 and July 1 as compared to the 2 early planting dates (middle May and early June). Consistent to 2013, corn planted between the middle of May and early June still had high yield (about 200 bu/ac at Etter and 170 bu/ac at Bushland) in mid- and long-season hybrids. Some of the short season hybrids (e.g., P9690AM) did not yield well at May 15 planting date because these plots had some stands losses from green snaps. In contrast, short season hybrids performed better than the longer season hybrids 33D53AM-R and P1151AM at two late planting dates.

Hybrids responded very differently to late planting dates. Consistent to 2013, hybrid 33D53AM-R (115 d) is very sensitive to late planting date, which cannot be planted in late June and early July in North part of Panhandle. In contrast, hybrid P1151AM seemed less sensitive to late planting. Short season hybrids generally performed very well at two late planting dates (June 15 and July 1). In particular, P9690AM and N42Z both yielded better than N41Y at July 1 planting date, probably due to the AquaMax (P9690AM) AgriSure Artesian (N42Z) drought tolerance

characteristics. Late planting resulted in a higher grain moisture and slightly lower test weight (Table 2 and 3).

Due to the time constraints for completing research work for closing Etter station,the soil moisture data after harvest were only collected in one replication. Consistent to 2013, seasonal ET reduced as planting date delayed and as hybrid relative maturity days decreased. However, the difference in ET between the earliest and latest planting dates was smaller (3 in) than that in 2013 (7 in). Nevertheless, planting late and using short season hybrids may result in irrigation water savings if there are some precipitations during growing season. We are still working on the water budget for Bushland data and present these data later. The WUE varied among planting dates and hybrids and the highest WUE was observed at May 30 planting date. Although the longer season hybrids had higher WUE than short season hybrids at May 15 and May 30 planting dates, the short season hybrids had higher WUE than long season ones at late planting dates (Table 2).

Conclusion remarks: The results from this study indicated that high yield still can be achieved with longer season hybrid (e.g., >111 d) when planted in the middle of May and early June in the Texas High Plains. When planting date was delayed to late June and early July, mid- and short-season hybrids showed the yield advantage over long season one. In general, delaying planting to late June or early July reduced yield potential. However, late planting reduced crop water use but did not affect WUE in short season hybrids. As such, late planting potentially can save some irrigation water while maintain the high WUE. How to increase the yield potential of short season hybrids with late planting needs further studies.

Based on 2014 season data, short season hybrids, particularly P9690AM planted on May 15 and June 1 had some green snap damages and resulted in stand losses and lower yield. Although green snap may not happen in every year, producers should be aware of the potential damage when planting short season hybrids too early.

The seasonal ET data in this study were calculated from first planting (May 15) to after harvest in the field. Therefore, soil evaporation between planting dates and after maturity was not subtracted from the total ET. The difference in ET among hybrids and planting dates will be greater after subtracting the soil evaporation.

Table 1. Silking (R1) and maturity (R6) dates, and growing degree days (GDD) in six hybrids on selected planting dates at Etter and Bushland, TX during 2014 growing season.

Planting date	Hybrid	Relative maturity	Silking date	Maturity date	GDDs	
					R1-R6	PL-R6
			Etter, TX			
15-May	33D53AM-R	115	26-Jul	26-Sep	741	1604
	P1151AM	111	20-Jul	23-Sep	803	1578
	P0365YHR	103	21-Jul	23-Sep	789	1578
	P9690AM	96	19-Jul	08-Sep	673	1435
	N41Y	96	19-Jul	12-Sep	708	1469
	N42Z-Artesian	96	19-Jul	19-Sep	772	1539
	Difference†		**7**	**18**	**130**	**169**
30-May	33D53AM-R	115	01-Aug	05-Oct	742	1534
	P1151AM	111	30-Jul	03-Oct	746	1518
	P0365YHR	103	29-Jul	01-Oct	749	1510
	P9690AM	96	27-Jul	16-Sep	624	1361
	N41Y	96	27-Jul	26-Sep	726	1463
	N42Z-Artesian	96	27-Jul	26-Sep	726	1463
	Difference		**5**	**19**	**125**	**173**
16-Jun	33D53AM-R	115	17-Aug	16-Oct	610	1429
	P1151AM	111	14-Aug	14-Oct	634	1406
	P0365YHR	103	12-Aug	12-Oct	652	1397
	P9690AM	96	12-Aug	08-Oct	627	1373
	N41Y	96	12-Aug	09-Oct	638	1383
	N42Z-Artesian	96	12-Aug	09-Oct	638	1383
	Difference		**5**	**8**	**42**	**56**
				Bushland, TX		
19-May	33D53AM-R	115		30-Sep		1646
	P1151AM	111		28-Sep		1626
	P0365YHR	103		23-Sep		1582
	P9690AM	96		10-Sep		1465
	N41Y	96		15-Sep		1498
	N42Z-Artesian	96		18-Sep		1527
	Difference			**20**		**181**
02-Jun	33D53AM-R	115		08-Oct		1556
	P1151AM	111		05-Oct		1528
	P0365YHR	103		01-Oct		1503
	P9690AM	96		16-Sep		1355
	N41Y	96		19-Sep		1384
	N42Z-Artesian	96		19-Sep		1384
	Difference			**22**		**201**

†The difference in either days or GDD between the earliest and latest silking or maturity dates.

Table 2. Yield, grain moisture, test weight, seasonal evapotranspiration (ET), and water use efficiency (WUE) in 6 hybrids at 4 planting dates in 2014 growing season at Etter, TX.

Planting date	Hybrid	Relative maturity	Yield[†]	Grain moisture[‡]	Test weight	Seasonal ET[§]	WUE
		d	bu/ac	%	lb/bu	in	bu/ac/in
May 15, 2014	33D53AM-R	115	235.6	14.2	62.5	25.2	9.35
	P1151AM	111	242.4	14.5	62.2	25.0	9.68
	P0365YHR	103	226.2	13.3	61.9	24.8	9.12
	P9690AM	96	146.5	12.5	58.5	24.2	6.06
	N41Y	96	197.3	12.1	59.8	23.9	8.27
	N42Z-Artesian	96	191.2	12.7	59.6	24.1	7.93
	Mean		**206.5**	**13.2**	**60.8**	**24.5**	**8.4**
May 30, 2014	33D53AM-R	115	236.8	14.9	61.9	22.5	10.54
	P1151AM	111	221.4	14.9	62.2	23.4	9.46
	P0365YHR	103	222.3	13.9	61.5	22.6	9.86
	P9690AM	96	183.5	12.7	58.0	20.6	8.91
	N41Y	96	207.7	12.8	59.2	21.0	9.88
	N42Z-Artesian	96	186.6	13.0	60.4	21.2	8.79
	Mean		**209.7**	**13.7**	**60.5**	**21.9**	**9.6**
June 16, 2014	33D53AM-R	115	161.3	16.6	60.6	22.0	7.34
	P1151AM	111	200.5	19.8	57.2	22.4	8.95
	P0365YHR	103	190.2	16.8	59.7	22.2	8.59
	P9690AM	96	180.7	14.9	57.4	21.2	8.54
	N41Y	96	177.8	16.7	58.6	21.8	8.16
	N42Z-Artesian	96	204.2	16.7	57.4	23.2	8.81
	Mean		**185.8**	**16.9**	**58.5**	**22.1**	**8.4**
June 30, 2014	33D53AM-R	115	109.3	11.5	56.0	21.8	5.03
	P1151AM	111	165.3	12.7	60.4	21.0	7.88
	P0365YHR	103	154.2	12.4	59.3	21.4	7.22
	P9690AM	96	169.7	11.3	57.3	20.1	8.43
	N41Y	96	154.3	11.4	56.4	21.4	7.22
	N42Z-Artesian	96	171.7	11.5	56.8	19.2	8.96
	Mean		**154.1**	**11.8**	**57.7**	**20.8**	**7.5**
CV (%)			**6.60**	**4.97**	**1.77**	**-**	**6.51**
LSD (P=0.05)							
Planting date (PD)			**7.68**	**0.66**	**1.10**	**-**	**0.35**
Hybrid (HB)			**10.30**	**0.57**	**0.87**	**-**	**0.46**
PD × HB			**20.59**	**1.13**	**1.74**	**-**	**0.92**

[†]Yield is based on 15.5% grain moisture; [‡]Grains in last PD were obtained after air drying for 3 weeks after harvest, resulting low moisture; [§]Seasonal ET was calculated from 1st planting (May 15) to after harvest (Oct. 31), and soil evaporation between planting dates and after maturity was not subtracted from the total ET.

Table 3. Yield, grain moisture, and test weight in 6 hybrids at 3 planting dates in 2014 growing season at Etter, TX[§].

Planting date	Hybrid	Relative maturity	Yield[†]	Grain moisture	Test weight
		d	bu/ac	%	lb/bu
May 19, 2014	33D53AM-R	115	145.2	11.2	60.3
	P1151AM	111	170.9	11.8	62.0
	P0365YHR	103	165.7	10.9	61.4
	P9690AM	96	127.8	11.7	58.0
	N41Y	96	134.5	11.5	58.4
	N42Z-Artesian	96	151.6	11.7	58.7
	Mean		**149.3**	**11.5**	**59.8**
June 2, 2014	33D53AM-R	115	150.0	13.0	59.9
	P1151AM	111	194.1	12.6	61.4
	P0365YHR	103	182.3	11.8	61.3
	P9690AM	96	147.8	11.6	58.7
	N41Y	96	140.3	11.5	57.6
	N42Z-Artesian	96	138.2	23.0	59.3
	Mean		**158.8**	**13.9**	**59.7**
July 1, 2014	33D53AM-R	115	112.4	19.8	55.1
	P1151AM	111	165.8	21.0	55.1
	P0365YHR	103	133.1	21.1	54.9
	P9690AM	96	115.7	17.1	55.2
	N41Y	96	133.0	17.6	54.6
	N42Z-Artesian	96	157.2	18.3	55.9
	Mean		**136.2**	**19.2**	**55.1**
CV (%)			**18.17**	**26.43**	**2.38**
LSD (P=0.05)					
Planting date (PD)			**20.33**	**3.56**	**1.49**
Hybrid (HB)			**22.20**	**NS**	**1.14**
PD × HB			**NS[‡]**	**NS**	**NS**

[§]The plots planted on June 13, 2014 were discarded due to stands issues; [†]Yield is based on 15.5% grain moisture; [‡]Not significant, P>0.05.